

Diversity of Acridoidea (Orthoptera) from southern and southwestern region of Bihar, India

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Abstract. The members of superfamily Acridoidea are notorious pests of crop fields, pastures, grasslands and forests. Defoliation is the most common mode of damage. The state of Bihar is located in 21°58'10" – 27°31'15"N latitude and 82°19'50" – 88°17'40"E longitude in eastern part of northern India and strives on agrarian economy. The state is part of the Ganga basin blessed with alluvial soil and rice, wheat and maize are the principal crops that are cultivated. The acridoid fauna of the area has not yet been worked out. Keeping this in mind, the state was surveyed and the collection was sorted out to yield 31 species representing 24 genera belonging to 19 tribes and 13 subfamilies. Among these the best represented families are the Acrididae with 26 species followed by the Pyrgomorphidae with six species.

Biodiversity, Acridoidea, Orthoptera, Bihar

Introduction

Orthopterans, especially the superfamily Acridoidea, have been amply reported as pests of agricultural crops, pastures and forests. Since this superfamily is economically important, attempts have been made to work out distributions of the harmful species. The order Orthoptera has paurometabolous or incomplete metamorphosis and many orthopterans (grasshoppers, crickets and locusts) stridulate by rubbing their wings against each other or the legs, the wings or legs containing rows of serrations. They are also good fliers capable of covering long distances when swarming.

The superfamily Acridoidea belongs in the suborder Caelifera (short-horned grasshoppers with three segmented tarsi, antenna shorter than the body and a short ovipositor; tympanum, when present, is on the first abdominal tergite). These insects are feared agricultural and forest pests inflicting harm chiefly by defoliation that drastically reduces the overall photosynthetic area Uvarov (1921, 1924, 1927, 1942) studied the Acrididae of India in detail. Agarwala (1952) contributed some studies on female copulatory structures in relation to oviposition sites, while Roonwal (1956) contributed some studies on the nymphal structures and ecology. Dirsh (1965, 1975), Tandon (1976), Shishodia (1987, 1997, 1999), Tandon & Shishodia (1969-1989), and Usmani & Shafee (1980-1990) have contributed very much to this field.

Bihar is a northeastern state, has a forest area of 6,764.14 km² and is a vast stretch of fertile plain. It is drained by the Ganges River, including its northern tributaries Gandak and Koshi that regularly flood parts of the Bihar plains. The total area covered by the state of Bihar is 94,163 km². The state lies in 21°58'10" – 27°31'15"N latitude and 82°19'50" – 88°17'40"E longitude. The Ganges divides the state into two unequal halves and flows through the middle from west to east. The winters (December and January) are mild, with the lowest temperatures being 4-10° C (40-50° F). The summers are hot, averaging 35-40° C (95-105° F). April through mid-June are the hot months. The monsoon months of June, July,

August and September bring good rainfall. October, November, February and March have a pleasant climate.

Agriculture is the backbone of Bihar's economy, employing 81% of the workforce and generating nearly 42% of the State Domestic Product. The percentage of population employed in the agriculture production system is much higher than the national average. Nearly 42% of GDP of the state (2004-2005) has been from the agriculture sector. The gross and net sown area in the State is estimated at 80.26 lakh ha and 56.38 lakh ha, respectively. The intensity of cropping is 1.42%. The principal crops are paddy, wheat, pulses, maize, potato, sugarcane, oil seeds, tobacco and jute. Rice, wheat and maize are the major crops. The average yields of rice and wheat are 1.45 and 2.19 t/ha, respectively. Though the area under cultivation is shrinking, there is a tremendous potential for income generation by improving productivity.

Material and methods

The project may be summarized as follows:

1) Collection of adult grasshoppers.

The authors surveyed various agricultural areas of the region during 2009-2010 for the collection of grasshoppers and locusts. Specimens were caught by hand and by ordinary aerial insect nets. The net was used for catching insects individually or by sweeping on grasses, bushes and other vegetation. Since some Acridoidea live in trees, it is sometimes highly rewarding to search branches. Attempts were made to collect specimens from their host plants. Different parts of crops were examined. Attention was also paid to fruits and vegetables. The collected specimens were killed in cyanide jars.

2) Preparation for morphological studies.

Dry mounts were prepared for better understanding of certain characters such as size, colour, texture, etc. For this purpose, the specimens were first relaxed, stretched, and later pinned and labeled. Permanent collections of pinned specimens were kept in storage boxes and cabinets for further studies.

3) Preparation for genitalic studies.

For a detailed study of the various components of the genitalia, permanent slides were prepared and examined under the microscope in order to make a detailed study of the structures. Drawings were initially made with the help of a camera lucida, and details were then filled in during a conventional microscope examination.

4) Preparation of keys.

Keys were based on the samples collected.

Results and discussion

While several works have dealt with the acridoid fauna of other states, the state of Bihar has not received much attention. Since the state's economic backbone is agriculture, it has become obvious that the situation must be remedied. In terms of published documentation the grasshopper fauna of Bihar is very poorly known, and this survey thus is the first step toward improving our knowledge.

The southern and southwestern regions of the have yielded samples belonging to 31 species representing 24 genera belonging to 19 tribes and 13 subfamilies. The recorded taxa are listed below.

Fauna of Acridoidea of southern and southwestern Bihar

Superfamily Acridoidea MacLeay 1821

Family Acrididae MacLeay 1821

Subfamily Acridinae MacLeay 1821

Tribe Acridini MacLeay 1821

1. ***Acrida exaltata* (Walker 1859)**

Material examined: ♀♀, ♂♂, 26-VI-2009, on paddy, Katihar; ♂♂, 24-VI-2009, on paddy, Banka; ♀, 29-X-2010, on grasses, Buxar; ♀♀, ♂♂, 9-VI-2009, on paddy, Patna; ♀, 8-VI-2009, on grasses, Begusarai; ♀, 6-VI-2010, on paddy, Ara, Bhojpur.

2. ***Acrida gigantea* (Herbst 1794)**

Material examined: ♀♀, 19-VI-2009, on paddy, Rajgir, Nalanda; ♀, 15-VI-2009, on paddy, Gaya; ♂, 11-VI-2009, on paddy, Bhabua, Kaimur; ♀, 24-X-2010, on grasses, Gopalganj; ♀♀, 13-VI-2009, on paddy, Sasaram, Rohtas; ♂, 9-VI-2009, on paddy, Patna; ♂, 8-VI-2009, on grasses, Begusarai; ♂, 23-X-2010, on wheat, Chhapra, Saran.

Tribe Phlaeobini Brunner von Wattenwyl 1893

3. ***Phlaeoba infumata* (Brunner von Wattenwyl 1893)**

Material examined: ♂, 11-VI-2009, on dead vegetation, Bhabua, Kaimur; ♂, 21-VI-2009, on paddy, Jamui.

4. ***Phlaeoba panteli* (I. Bolivar 1902)**

Material examined: ♀, 22-VI-2009, on dead vegetation, Munger.

Subfamily Gomphocerinae Fieber 1853

5. ***Leva indica* (I. Bolivar 1902)**

Material examined: ♀, 4-VII-2009, on paddy, Jehanabad.

Tribe Gomphocerini Fieber 1853

6. ***Chorthippus Indus* (Uvarov 1942)**

Material examined: ♂, 29-VI-2009, on grasses of vegetable field, Gaya.

Tribe Arcypterini Shumakov 1963

7. ***Aulacobothrus luteipes luteipes* (Walker 1871)**

Material examined: ♀, 14-VI-2009, on lady finger, Aurangabad.

Subfamily Oedipodinae Walker 1871

8. ***Chloebora grossa* (Saussure 1884)**

Material examined: ♂, ♀, 13-VI-2009, on grasses of Chand Tan Shahid Pir, Sasaram, Rohtas.

Tribe Trilophidiini Shumakov 1963

9. ***Trilophidia annulata* (Thunberg 1815)**

Material examined: ♀♀, 16-VI-2009, on sugarcane, Gaya.

Tribe Epacromiini Brunner von Wattenwyl 1893

10. ***Aiolopus simulatrix* (Walker 1870)**

Material examined: ♂♂, ♀♀, 11-VI-2009, on paddy, Bhabua, Kaimur; ♀♀, 15-VI-2009, on paddy, Gaya; ♂♂, ♀♀, 21-VI-2009, on paddy, Jamui; ♀, ♂♂, 22-VI-2009, on paddy, Munger; ♂♂, 23-VI-2009, on paddy, Khagaria; ♀, 6-VI-2010, on paddy, Ara, Bhojpur.

11. ***Aiolopus t. thalassinus* (Fabricius 1781)**

Material examined: ♀, 25-X-2010, on wheat, Aurangabad.

Tribe Locustini Kirby 1825

12. ***Oedaleus senegalensis* (Krauss 1877)**

Material examined: ♂, ♀, 20-VI-2009, on paddy, Nawada.

13. ***Locusta migratoria* (Linnaeus 1758)**

Material examined: ♂, 11-VI-2009, on arhar, Bhabua, Kaimur.

Tribe Acrotylini Shumakov 1963

14. ***Acrotylus insubricus insubricus* (Scopoli 1786)**

Material examined: ♀, 9-VII-2009, on paddy, Jamui.

Tribe Oedipodini Walker 1871

15. ***Oedipoda miniata miniata* (Pallas 1771)**

Material examined: ♀, 14-VI-2009, on arhar, Aurangabad; ♀♀, 20-VI-2009, on maize, Nawada; ♀♀, 21-VI-2009, on sugarcane, Jamui.

Subfamily Truxalinae Serville 1838

16. ***Truxalis nasuta* (Linnaeus 1758)**

Material examined: ♀, 21-VI-2009, on paddy, Jamui.

Subfamily Oxyinae Brunner von Wattenwyl 1893**Tribe Oxyini Brunner von Wattenwyl 1893**17. ***Oxya grandis* (C. Willemse 1925)**

Material examined: ♀, 25-VI-2009, on paddy saplings, Bhagalpur.

18. ***Oxya hyla hyla* (Serville 1831)**

Material examined: ♀♀, 24-X-2010, on grasses, Gopalganj; ♀, 24-VI-2009, on paddy, Banka; ♀, 13-VI-2009, on paddy, Sarsaram, Rohtas.

Subfamily Hemiacidinae Dirsh 1956**Tribe Hieroglyphini Mishchenko 1965**19. ***Hieroglyphus banian* (Fabricius 1798)**

Material examined: ♀, 18-VI-2009, on paddy, Jehanabad.

Subfamily Spathosterninae Rehn 1957**Tribe Spathosternini Rehn 1957**20. ***Spathosternum prasiniferum* (Walker 1871)**

Material examined: ♂, ♀, 19-VI-2009, on paddy, Bihar Sharif, Nalanda; ♀♀, 24-VI-2009, on paddy, Banka; ♀, 23-VI-2009, on grasses, Khagaria; ♀, 16-VI-2009, on paddy, Gaya; ♀, 9-VI-2009, on paddy, Patna; ♀♀, 29-X-2010, on grasses, Buxar; ♂♂, ♀, 27-X-2010, on grasses, Hajipur, Vaishali; ♀, 8-VI-2009, on grasses, Begusarai; ♀♀, 7-VI-2009, on grasses, Luckeesarai.

Subfamily Catantopinae Brunner von Wattenwyl 1893**Tribe Catantopini Brunner von Wattenwyl 1893**21. ***Catantops pinguis* (Stal 1861)**

Material examined: ♂, 26-VI-2009, bushes and wild vegetation, Bhagalpur.

Subfamily Cyrtacanthacridinae Uvarov 1923**Tribe Cyrtacanthacridini Kirby 1902**22. ***Schistocerca gregaria gregaria* (Forskål 1775)**

Material examined: ♂, ♀♀, 18-VI-2009, on maize, Jehanabad.

Subfamily Eyprepocnemidinae Brunner von Wattenwyl 1893

Tribe Eyprepocnemidini Brunner von Wattenwyl 1893

23. *Eyprepocnemis alacris alacris* (Serville 1838)

Material examined: ♀, 21-VI-2009, on maize, Jamui; ♀, 18-VI-2009, on bushes, Jehanabad.

Subfamily Tropidopolinae Jacobson 1905

Tribe Tristriini Mishchenko 1945

24. *Tristria pulvinata* (Uvarov 1921)

Material examined: ♀♀, 13-VI-2009, on grasses, Sasaram, Rohtas.

Subfamily Calliptaminae Tinkham 1940

25. *Acorypha glauropsis* (Walker 1870)

Material examined: ♂♂, ♀♀, 13-VI-2009, on hilly grasses of Chand Tan Shahid Pir, Sasaram, Rohtas.

Family Pyrgomorphidae Brunner von Wattenwyl 1882

Subfamily Pyrgomorphinae Brunner von Wattenwyl 1882

Tribe Chrotogonini Bolívar 1904

26. *Chrotogonus oxypterus* (Blanchard 1836)

Material examined: ♀♀, ♂♂, 23-VI-2009, on grasses, Khagaria; ♀♀, 16-VI-2009, on paddy, Gaya.

27. *Chrotogonus armatus* (Steinmann 1965)

Material examined: ♂♂, ♀, 16-VI-2009, on paddy, Gaya; ♀♀, 13-VI-2009, on grasses, Sasaram, Rohtas.

Tribe Atractomorphiini Bolívar 1905

28. *Atractomorpha psittacina psittacina* (Haan 1842)

Material examined: ♂, 23-X-2010, on underlying grasses in vegetable field, Chhapra, Saran; ♂, ♀♀, 25-X-2010, on grasses, Sasaram, Rohtas.

29. *Atractomorpha burri* (I. Bolivar 1905)

Material examined: ♂♂, 23-X-2010, on underlying grasses in vegetable field, Chhapra, Saran.

30. *Atractomorpha himalayica* (I. Bolivar 1905)

Material examined: ♀, 18-VI-2009, on paddy, Jehanabad.

Tribe Poekilocerini Jacobson 1905

31. *Poekilocerus pictus* (Fabricius 1775)

Material examined: ♀, 24-VI-2009, on *Calotropis procera*, Banka.

To enact any sort of control strategy, one must have an idea of distribution pattern, primary host plant, secondary host plant (in case the primary host is temporarily absent and the pest flourishes on some other vegetation in the intervening period), infestation rate, etc. The distribution pattern may also be a reflection of the soil type, climate, type of insecticides used and demographic patterns of the particular area.

The acridoid fauna of the area surveyed and discussed in this paper has never before been documented, and therefore this study is critical to giving an idea of distribution and infestation of the concerned group. Paddy showed more infestation followed by pulses while wheat crop had very little population of grasshoppers.

Grasses surrounding the crop field proved to be secondary / intermediate host for the grasshoppers in absence of crops.

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